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BUREAU OF SUGAR EXPERIMENT STATIONS

BRISBANE QUEENSLAND

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BUREAU OF SUGAR EXPERIMENT STATIONS
BRISBANE

THE CANE GROWERS' QUARTERLY BULLETIN

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This Bulletin is an official publication of the extension service of the Bureau of Sugar Experiment Stations, issued and forwarded by the Bureau to all cane growers in Queensland.

The Cane Growers' Quarterly Bulletin

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EDITORIAL

Research in Sugar Cane Agriculture

During the currency of the Annual Conference of the Queensland Society of Sugar Cane Technologists at Cairns last April reference was made to the number of contributed papers on agricultural topics. There were thirteen papers out of a total of thirty-eight, the remaining twenty-five dealing with administrative, engineering and manufacturing matters.

At another conference—that of the Cane Pest and Disease Control Boards—immediately following on the Technologists meeting, eight more papers dealing with cane diseases and pests were submitted and discussed.

These twenty-one contributions covered a wide variety of subjects, ranging from cane breeding and weed control to chlorotic streak disease research, and new insect pest records. They represented, in some cases, progress reports of investigations and discoveries during the past year.

Such published material, together with the regular dissemination of information, through the Cane Growers' Quarterly Bulletin, forms an excellent medium for extending research findings to the cane growing community.

The principal value of agricultural investigation lies in the rapid translation of research findings into farm practice.

Aerial Fertilizing — Some Distribution Patterns

By G. C. BIESKE

Introduction

Aerial fertilizing is a comparatively recent innovation in the Queensland sugar industry and has probably been fostered by the increasing use of urea, the pelleted form and non-foliar damaging properties of which render it suitable for application from aircraft. Hawaiian experiences with aerial applications of urea reveal a tendency towards uneven distribution which is later detectable by differences in leaf colour and in that country, improvement in spreader design was necessary to rectify this unevenness.

The first aerial application of urea in the Mackay district was performed towards the end of 1957. Later observations revealed the presence of an uneven growth pattern which persisted through to harvest. This prompted the checking of distribution patterns when aerial top-dressing was again practised on a small scale late in 1958.

Aircraft Details

The aircraft operating was a Tiger Moth with a Gypsy Moth engine. The propeller movement when viewed from the cockpit was anti-clockwise. A hopper of approximately 5 cwt. capacity was connected to a spreader or distributor which was slung below the fuselage. In the three tests carried out the aircraft operated at an altitude of 40 feet and an air speed of 65 knots. The distance between successive swath centres was 30 feet which, it was considered, would allow an adequate overlap.

Distribution Measurements

The urea was caught in square containers consisting of plastic sheeting with a wooden surround, three inches high. Preliminary investigations indicated the suitability of the plastic material because of the comparative lack of bounce of the urea pellets when striking it. The containers were one square yard in area and were placed in successive interspaces. Any foliage which might have deflected urea from the containers was removed. The urea caught in each container was transferred to a screw top jar and the contents weighed. During each test, the containers were left exposed while the aircraft carried out runs on both sides of the catchment area. Consequently, the distribution patterns obtained refer to overall patterns and not to individual swath dosage patterns.

First Test.—The urea was caught in three separate containers in each of seven successive interspaces. Conditions were unfavourable due to a gusty cross-wind reaching up to an estimated five knots. The effect of the wind was apparent by the fact that the majority of the urea collected was deposited during the run made just outside, and to windward of the catchment area. The distribution pattern is shown in Fig. 1. Although the average application rate per interspace ranged from 63 to 229 lb. of urea per acre, the average rate per acre calculated from the total quantity caught was 118 lb. per acre. This agreed reasonably well with the actual quantity of urea applied to the field, the average rate per acre amounting to 112 lb.

Second Test.—The second set of measurements was carried out shortly afterwards on the same field as for the first test, but the atmospheric conditions now ranged from calm to a very slight breeze. Insufficient time was available to place the wooden frames around the plastic containers but observations during the dropping period indicated that there was little run of urea pellets after striking the

sheeting. At any rate the results should be precise enough to judge the dosage distribution efficiency. The results of this test are illustrated in Fig. 1.

Third Test.—In view of the uneven distribution patterns obtained in the above tests, an attempt was made to modify the aircraft's distributor in order to lessen the heavier dressing being applied to the right of the line of flight, an occurrence associated with the direction of rotation of the propeller. At the same time the lay-out of the ground containers was altered to two containers in each of ten consecutive interspaces, this arrangement allowing observations on a wider distribution dosage pattern. Conditions were calm while the test was in progress and the results are also presented in Fig. 1.

Discussion

An examination of the distribution patterns illustrated in Fig. 1 indicates the large row by row variation in distribution of the urea even though the overall application rate was close to the predetermined rate. The first effect of the uneven fertilizing was observed in growth variations of weeds in the treated blocks, weed density and vigour exhibiting a fairly regular wave form. Colour and stooling differences were noted later in the stands of cane. Stalk counts per chain of row also clearly demonstrated the uneven cane growth which occurred in the field where the first and second tests were made. Increased stalk length was also associated with the higher stalk population.

Factors influencing uneven distribution in these experiments were the aircraft distributor design and wind

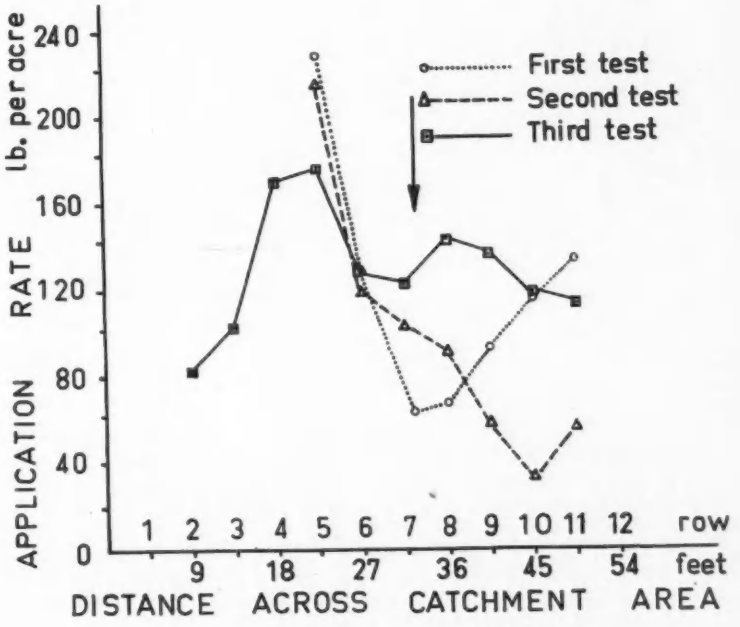

Figure 1—Showing distribution patterns of the three tests

velocity and direction. The installation of a deflector vane on the distributor air intake appeared to improve the application in the third test but room still exists for improvement.

The effect of wind may be gauged from the drift which occurred during the first test, the prevailing air movement causing a side drift of approximately 30 feet. Frequent velocity changes associated with gusty winds could therefore subject the falling fertilizer to various degrees of drift with a resultant uneven distribution irrespective of aircraft spreader design.

Conclusions

Aerial fertilization has several advantages over ground application, viz., speed of application and ability to perform the top-dressing when the soil is too wet or the cane too far advanced for tractors to enter the fields. However, tests of aerial distribution patterns combined with visual observations of consequent cane growth indicate uneven application and the consequent necessity for modifications to the aircraft distributor to ensure a more uniform distribution. No mention has been made of the higher costs involved in aerial top-dressing, but this important point adds more weight to the need for an acceptable distribution of aerially applied urea.

Chlorotic Streak Disease in the Burdekin District

Following the eradication of downy mildew and mosaic diseases from the Burdekin many years ago, this area has been regarded as being one of the least affected by disease in the State —so much so that growers from other areas sometimes used to seek permission to transfer stocks of Badila from there to act as nursery stocks for building up their future supplies of clean planting material.

In common with all other Queensland cane-growing areas, ratoon stunting was subsequently located there, and except for localized recurrences of this trouble, against which corrective steps were promptly taken, the position remained fairly satisfactory until recently, when chlorotic streak made its appearance in the Down River section of the Inkerman area, which is subject to flooding. The finding of chlorotic streak under such circumstances was not altogether unexpected, particularly since the same disease had been found under similar conditions on farms fringing the Haughton River in the neighbouring Giru area. However, the Down River occurrence triggered off a survey, which embraced low lying farms on the opposite bank of the Burdekin, and as a result a light infection of the disease was also located on Rita Island.

The farms affected have been quarantined, but all growers in these areas should be most particular about obtaining their planting material from safe sources. Prior consultation with their Field Supervisor or with a Bureau officer will ensure this.

If such a course of action is followed and fresh stocks of hot water treated cane are regularly obtained, there is every reason to be optimistic that chlorotic streak disease will have little impact on this area and that the Burdekin will regain its reputation of being comparatively disease-free.

Progress in the Development of New Varieties

By J. H. BUZACOTT

Introduction

With the increase in staff in the Division of Plant Breeding in the Bureau of Sugar Experiment Stations which has taken place in the past six or seven years, the cane breeding programme has gradually gathered impetus and new varieties are now rolling off the assembly line at a steady rate. An ambitious experimental programme has been initiated and, as the results of the experiments become evident and can be applied in practice, it is expected that more and more new and better varieties will become available to the farmer. It is thought that a review of recent developments might be of interest both to farmers and technologists, at least on the agricultural side, and, accordingly, a brief review of recent progress in cane breeding is now presented.

Cross Pollination

Following the discovery that contamination from outside pollen was occurring in our voile lanterns and in open dispersed crosses, the whole of the cross-pollination programme is now conducted under pollen-proof lanterns. The great importance of this is from the research point of view since no faith can be placed in the results of any experimental work unless the cross is free of any possibility of pollen contamination. The investigations conducted by our Senior Geneticist into pollen contamination have had some interesting repercussions in other cane breeding countries, and following the publication of his Technical Communication on the subject several enquiries have been received from overseas requesting further details of our methods.

Fuzz Storage

Seed production is one of the costliest stages of the development of new varieties. Investigation into storage temperatures has shown that seed will retain its viability for several years when stored at low temperatures. We have already demonstrated that seed stored for three years at a temperature of—10°C. to —15°C. will germinate well and grow vigorously, whereas, with seed stored at from 0°C. to 5°C., the germination falls off considerably in the second year and the vigour of the seedlings also deteriorates. In view of this fact adequate low temperature storage space has now been provided to store quantities of seed sufficient for our purposes.

Seedling Raising

In the past, in some years, the planting-out programme has been seriously curtailed by loss of seedlings in the glasshouse. Steps have now been taken to standardise the composts used for seedling raising. The provision of better facilities for glasshouse temperature control is also assisting to ensure adequate supplies of young seedlings to fulfil the requirements of our four experiment stations.

Bunch-planting versus Single-planting

For several years there has been some controversy in the cane-breeding world as to the relative merits of bunch-planting original seedlings when compared with single-planting. Comprehensive experiments have shown that, under Queensland conditions, both methods have merit and, accordingly, bunch-planting has now been adopted for special purposes in the seedling programme. In fact, although more area is still devoted to single-planted seedlings, far more seedlings now reach the field as bunches than as single plants. The

experimental work with bunch-planting is still being continued and the results of this work will determine the degree to which bunch-planting will finally replace single-planting in our normal seedling-raising activities. In addition, bunch-planting now occupies an important place in the selection of new parent canes. For this purpose the method is very suitable as it enables a rapid elimination of those seedlings which are unlikely to flower.

Selection

It is in the realm of selection that possibly the greatest progress has been made. Bearing in mind that, due to the large number of features required in modern varieties, initial numbers must be large, the programme has been built up so that some 75,000 individual seedlings are planted each year. This number is comparatively small compared with the numbers handled in some countries, but it is necessary to effect a compromise between the available personnel and the numbers which can be planted out and properly selected and this number seems to balance nicely with our selection rates and the area available for planting selections. Carefully planned experiments have also shown that a higher selection rate than previously used is desirable in the early stages of selection and this has resulted in the interpolation of a 4-sett plot stage between the original seedlings and the 30-sett or 40-sett plot stage to which the originals were formerly taken. A further innovation, based on the results of experiments, is the introduction of replication at an earlier stage, and to this end replicated yield-observation trials have now been substituted for the unreplicated yield-observation trials formerly used.

Another desirable feature has been shown to be that of conducting selection, as far as possible, in the area in which the varieties are intended to be grown. To this end considerable expansion of activities has taken place and either sub-stations or large scale introduction plots have now been established at Babinda, Innisfail, Tully, Isis, Maryborough and Moreton. At the same time a greater number of varieties are being planted each year in farm observation trials in all mill areas in the state.

Conclusion

The net result of all this work must be more and better varieties for the industry. The result of these latest developments will not be manifest for some eight to ten years, as it takes approximately that period to develop a commercial variety from the seedling stage. However, there has been steady progress before the introduction of these rather sweeping changes in method, and this progress is reflected in the number of new varieties which have been made available to the industry in recent years. The following table shows the Q varieties which have been approved in each year over the past ten years:—

Year	Q. Number
1950	Q.51
1951	Q.55
1952	nil
1953	nil
1954	Q.57
1955	Q.58
1956	Q.56, Q.59
1957	Q.61, Q.64
1958	Q.63, Q.65, Q.66, Q.70
1959	Q.67, Q.68
1960	Q.69, Q.71, Q.72, Q.73

It requires but a brief glance at the table to appreciate that new varieties are now made available to the industry in far greater numbers than previously.

The tremendous impact made on the industry by varieties such as Q.28, Trojan, Q.50 and Pindar may not be repeated by individual varieties in the future, as, even though the standard becomes increasingly higher, many more varieties are now reaching the status of approval and the

competition is correspondingly keener. Still, one is never sure in forecasting the future of varieties; for instance, few would have expected the thin Q.58 ever to become a possible contender for the position of premier variety in the state. There does, however, seem to be a strong indication that in the future no single variety will so nearly dominate the varietal landscape as Q.50 and Pindar have during recent years, in sharing more than 50 per cent. of the total Queensland crop between them. Instead, there has been a tendency to produce varieties to suit relatively smaller ecological sites and, as a result, although each district will no doubt still have its major variety, there will be a greater number of quantitatively important varieties in the state. This state of affairs is already portended by recent events. Twelve years ago only one variety exceeded a million tons in one year and the next variety in importance produced only one third of its tonnage. In 1958 two varieties exceeded the 2,000,000 ton mark, one produced 1,500,000 tons and no less than five yielded from 400,000 to 600,000 tons each. At least three in the latter group will increase their contribution very considerably in the near future.

The question may be asked, "Are we now producing too many new varieties?" The answer is definitely in the negative. In the first place new varieties are unlikely to be approved unless they are capable of giving yields comparable with those of existing standards. Secondly, there are still many more varieties required for specific purposes, such as drought resistance and lodging resistance, to mention but two. Finally, in spite of overproduction, the best way to achieve greater profits is to produce the same amount of sugar on less land and any new variety which assists in doing this must become popular in the industry.

Random Gleanings

The Bureau's efforts to have seed of Malabar pea available on a commercial basis are beginning to bear fruit. Following last year's appeal to Lower Burdekin farmers there have been appreciable acreages of Malabar pea planted for seed production. And, in addition, there should be a reasonable supply of seed forthcoming from commercial growers at Wondai. This proven variety of cowpea will be a very welcome addition to the range of legumes available to Queensland cane growers.

Velvet Beans, a highly valued green manure crop on cane farms, are destined to go out of favour in the far north. A new type of wilt is making serious inroads into crops in the wetter areas and, since the wilt organism can remain in the soil for a period of years, it would appear that growers on affected properties will have to change over to some variety of cowpeas. This circumstance will increase the demand for Reeves and Cristaudo seed and will doubtless cause keen competition for the limited supplies of Malabar pea. The cowpea types are resistant to the new wilt which is affecting velvet beans. To date there have been no reports of this new wilt south of the wet belt.

Prickly Cucumber Control

By C. A. REHBEIN

The majority of weeds in cane paddocks can be controlled fairly simply by cultivation in the early life of the crop. Their presence in mature cane is regarded as a nuisance and is tolerated because in the process of burning prior to harvest they are readily destroyed. However, there is a small category of weeds, mainly of climbing habit, which not only restrict growth, cause premature lodging, but after the fire has passed through the field we find that the foliage has been destroyed whilst the vine remains intact.

Harvesting a field in which these vines are present slows down cutting rates and of most importance attracts higher cutting charges for the grower.

Unfortunately, the life cycle of these weeds is such that germination generally takes place when the cane is just out of hand, whilst fruiting and seeding is completed before harvest, so that, their threat to the crop is not evident until a fairly large area is infested. In the case of Convolvulus and Star of Bethlehem, aerial spraying with 2,4-D is sufficient for control as both these species are very susceptible to hormones. The horned African cucumber (*Cucumis metuliferus*) has some resistance and aerial spraying with 2,4-D is not entirely successful. The appearance of this weed in cane on the Mulgrave River flats is causing some concern. Introduction of the vine is not definite although some theories have been suggested. Spreading of the seed is comparatively easy as they will adhere to footwear, tramrails, tractor tyres and particularly in the tracks of crawler type vehicles.

As a result of an unsuccessful control through aerial spraying with 2,4-D, experiments were set down to determine which weedicide would

Fig. 2—Showing the extent of infestation by wild cucumber in a block of cane.
—Photo B. T. Egan

eliminate the vine at the most economical cost. The area chosen was in plant cane of some eight feet overall height, which had a moderate stand of this weed throughout. Very heavy infestations were available but it would have been impossible for the operator to use the knapsack spray successfully as the vines choked the interspace and rested over the top of the cane. The following weedicides were selected :

Fig. 3—Wild cucumber can be a problem in standing cane. Aerial spraying with 2, 3, 5—T is effective.

—Photo B. T. Egan

Butoxone 80. (2,4,5-T 80% w/v as butyl ester)

Nocweed (17.8% w/v 2,4-D as ethyl ester); 16.4% w/v 2,4,5-T as butyl ester).

Amitrol, 50% active ingredient (amino triazol).

To ensure good coverage 100 gallons of water per acre were used and the rates of application as under—

Butoxone 80 — 1 pint and one half pint per acre.

Nocweed — 6⅔ pints per acre.

Amitrol — 18¾ and 12½ lb. per acre.

As is the case with knapsack spraying good coverage is assured and the plants received a thorough wetting. Within two days the effect of both treatments of Butoxone 80 was showing in the form of wilting foliage. The Nocweed treatment had some leaf burn but no distortion was visible. At the end of one week severe damage and death was obvious in the Butoxone 80 treatments, the heavier dosage being the more advanced. Wilting and distortion of the plants had commenced in the Nocweed treatment whilst in both applications of Amitrol some chlorosis was evident in the new growth particularly where the plant had been exposed to sunlight. A further inspection two weeks from the date of application revealed complete kills in the Butoxone 80 and Nocweed plots. The Amitrol treatment of 18¾ lb. per acre had odd dead vines throughout, the remaining plants were chlorotic and unhealthy. No death had occurred in the 12½ lb./acre plot of this chemical. Some cane stalks in both treatments of Amitrol were affected having chlorotic areas around the base of the spindle leaves.

A final inspection some five weeks after the initial spraying showed that the Amitrol treatments had eliminated the cucumber. As an interesting side note this chemical had also destroyed most of the heavy weed and grass growth at the end of the plots.

The conclusions drawn from this experiment are that 2,4,5-T 80% w/v at the rate of ½ pint per acre will control the wild cucumber quickly and satisfactorily at a cost of approximately £1 per acre for material. The Nocweed preparation has given a satisfactory if slower control at approximately the same cost whilst Amitrol at the rates applied is far too expensive. A further trial on a cost per acre basis using 2,4,5-T 80% at ½ pint per acre and Amitrol at ¾ lb. and 1½ lb. per acre showed that only 50 per cent. control could be expected of the lower rate of Amitrol whilst the higher application was equivalent in control to the ½ pint of 2,4,5-T but was twice as expensive. These findings refer only to knapsack or inter-row tractor sprayings and do not necessarily apply to aerial application which may be affected by the density of foliage of the individual varieties.

Fig. 4—A chlorotic streak trail in the Mackay district showing marked difference in primary vigour between diseased and healthy young plant cane, variety Q.56. Diseased on left, healthy on right.

Field Day Address — Meringa, 1960

By L. G. VALLANCE

The use of green manure crops has now become a well established practice throughout the sugar industry. All growers are well aware of the advantages resulting from the fact that they provide such desirable features as soil protection from early summer storms and wet season rains, repression of weed growth during the fallow and the replenishment of soil organic matter. Nowadays these are all part of normal efficient farm management. In addition the leguminous plants which are used for these crops are capable of absorbing considerable quantities of the nitrogen which is contained in the air. This ultimately becomes available to the cane crop as the legume decomposes and releases its nitrogen to the soil.

As might be expected it is difficult to measure the actual amount of nitrogen that is made available in this way. Usually, however, it is sufficient to supply the complete requirements of the plant crop of cane. The Bureau has just completed a series in which some forty trials were set out to determine whether additional nitrogen (other than the small amount applied in the planting mixture) in the form of sulphate of ammonia or urea should be given to plant cane on land where a good green manure crop had been turned in prior to planting. A large number of observations were made and, with a few exceptions, it was quite evident that the green manure crop was capable of supplying all the nitrogen required by the plant. The exceptions were mainly confined to the Mackay district. Under these circumstances the desirability of growing a green manure crop needs no further elaboration.

In the full realisation that a cover crop is not grown without the expenditure of both time and money the Bureau has been active in its search for better and more reliable green manures. Originally, the cowpea in its various forms was used very widely and perhaps the best known variety was Poona pea. However, the susceptibility of these peas to wilt and bean fly attack made them a chancy crop, particularly in the wetter years. As time went on they were replaced by the velvet bean which, because of resistance to disease and insect damage and also because of its excellent habit of growth, became very popular in practically all sugar districts. This was so much so that it seemed that velvet bean was the final answer to cover cropping requirements and that the cowpeas would disappear. However, there are now signs in certain areas that the wheel has turned another circle with the cowpea returning and the bean on its way out.

In early 1957 a new type of wilt disease appeared which attacked and drastically laid low several velvet bean plantings. Since then the disease has become more wide-spread and the complete failure of velvet bean crops in parts of the Mulgrave and Hambledon areas is now a frequent occurrence. Because the disease organism lives in the soil it is useless to re-plant velvet beans on land where a previous failure due to this cause has occurred. At this stage it is not known how long the disease will persist in the present affected soils, but numerous failures again this year, indicate that it is still most active and must be considered likely to remain so for some considerable time.

Fortunately, the available evidence to date is that the cowpea is immune to this new type of wilt. It is fortunate also that the modern varieties of cowpea which are now available have

a high degree of resistance to the diseases and pests which caused previous cowpeas to be discarded in favour of the velvet bean.

Perhaps the best known variety of these is Reeves which is producing excellent crops on land where failures of velvet beans have occurred. A later product of the Bureau's legume testing and breeding programme is the cowpea known as Malabar. This legume has now been released for two or three years and its performance indicates that it is admirably suited for cover cropping in North Queensland canefields. Its growth and habit is similar to that of Reeves, but it is somewhat more vigorous. It produces a bulkier crop and has good weed smothering ability in the early stages.

The Bureau has made strenuous efforts to interest commercial seed growers in producing seed and it is hoped that eventually the present shortage will be overcome. Growers who are interested in trying Malabar for this year's planting would be well advised to make early arrangements for their seed supplies.

Our legume breeding project which is carried on here at Meringa is showing very satisfactory results. The progeny of the many cowpea crosses are undergoing trial at all of our Experiment Stations in order to determine their suitability for conditions in the various districts. There are many excellent types among these and there seems little doubt that they will form a nucleus from which will come green manures of considerable value to growers in numerous areas. The failure of a cover crop involves a farmer in a substantial loss, both in time and in money and if our work can provide the means for avoiding this, the project will have been well worthwhile.

These days, cost of production is a matter which causes considerable anxiety and, as you know, much of the work of the Bureau is directed to finding out the most economical ways of performing the various essential operations required for efficient crop production. One such avenue that has very distinct possibilities is the use of lindane for grub control.

The Bureau has encouraged both the use of this material and also the development of suitable spray equipment for its application. The method has now been fairly extensively used in the Burdekin district and the users have been very happy with the results.

Since lindane is a very concentrated form of BHC a dosage rate of 2 lb. per acre is the equivalent of the 75 lb. of the normally used BHC dust. To apply this small amount it is desirable to mix it with water and to use a suitable type spray, i.e., the application is made in the liquid form and not as a powder. There are several advantages in using lindane. First and foremost is the fact that on present prices the cost of material per acre is approximately cut in half. This is a worthwile saving. Another advantage noted by Burdekin growers is the much faster rate at which a block can be treated. Moreover, as far as actual physical comfort is concerned the use of the spray has much to commend it. The dry powdery form of BHC, at times caused the operator to work under dusty conditions of a somewhat disagreeable nature.

To anyone who is interested in obtaining further details of this latest technique of grub control I would suggest that it would be worthwile to get in touch with a local Bureau officer, or Pest Board supervisor. It could be a real opportunity to save money.

Some Angles of Mechanical Cane Harvesting

By NORMAN J. KING*

Mechanical harvesting has its protagonists and antagonists within the industry and, doubtless, the subject will continue to be debated within the industry for a considerable number of years. The design of suitable machines is a matter for engineers; the output of cane and the ancillary problems of delivery from field to mill are matters for cane inspectors and transport officers; and the equity question which may be introduced by material not classifiable as "whole cane" will be resolved by some other organization than my own.

So, because of the very nature of these matters, I do not intend to discuss them. I am proposing, however, to comment on some aspects of mechanical cane handling which could be pertinent to the overall subject.

It is very desirable, in any consideration of a changeover to mechanical harvesting, for the industry to grow erect cane, and this varietal characteristic has been kept well in mind by the people responsible for breeding and selecting our modern varieties. But although it may be a simple concept to restrict our selections to canes with an erect habit of growth under normal conditions it is much more difficult to retain that erectness under diverse field environments. The most erect crops can lie down, or lean badly, as the result of high rainfall making the soil sodden and soft, or as the result of high winds of short duration or cyclonic blows. On some rich soils where certain cane varieties produce crops with a heavy top the crops will frequently fall over even without the assistance of rain or wind.

The industry's experience during the last ten years or so, when it has been growing large areas of modern-type canes, has shown that most varieties tend to spread or lodge under some of these conditions. The position is at its worst on river flats, on rich pockets which occur in some northern areas, and on the Burdekin delta. There is nothing that can be done to correct this leaning and lodging so long as the same varieties are planted and the unfavourable climatic conditions obtain.

But some success has been achieved in recent years in the breeding of canes which are lodging resistant in varying degrees. I have spoken to you about these previously. The most successful one is Q.66 which normally remains erect on the richest lands, even under conditions of flood or high winds. The result has been a high demand for the variety for rich land conditions in several mill areas of the far north. One can appreciate quite easily the advantages of such a variety over its predecessors if mechanical harvesting becomes a standard farm practice in those districts, and one can also assess the lower cost of handling a cane which is erect, in contrast to the flat and tangled crops which normally characterise those farms.

However, Q.66 is not the final answer. It is suited only to the best class lands and it is more disease susceptible than we like a variety to be. It does, though, demonstrate a major step forward in this dual problem of tailoring a variety to fit a mechanical harvester, and eliminating the higher costs associated with cutting lodged crops.

In certain other districts the "erect crops" requirement has been met to a smaller and less satisfactory degree. Q.57 in Babinda and other districts is superior to several of the other commercial canes, but it does possess the serious disability of lodging during the pre-harvest burn — particularly if the burn is a hot one.

* Address to Annual Conferences Q.C.G.C. and A.S.P.A. (1960)

Q.67 is performing very well in the Lower Burdekin, even under flood and cyclone conditions. And N.Co. 310 can withstand high winds and wet soils better than most other varieties grown in the areas where it is successful.

These are our first steps in building up a supply of canes which have a better chance of remaining erect under difficult conditions and they make more possible the approach to mechanical harvesting with machines which demand erect cane.

The phase of over-production which we are experiencing — and which is not likely to be a passing phase — will not tend to ease the problems of mechanical harvesting. Surplus cane which may be left for the second year will tend to complicate the problem because of side-shooting, suckering, dead stalks, rat damage and lodging. On very fertile soils even the lodging resistant canes cannot be expected to remain erect in a two-year crop; and the long stalks produced in a two-year crop will introduce new difficulties in regard to machine design. This applies particularly to the height at which the topping mechanism can work, and the limitation of both the conveyor system and the container which collects the stalks into bundles. Some harvesters lay the cane bundles at right angles to the cane row, and with this type the lower cane is more likely to interfere with the next run of the harvester.

In recent times the question has been asked whether cane breeding is tending to produce more brittle canes than we have grown in the past. This is possibly related to the belief that very sweet varieties are soft and easily broken; and possibly the questioners have in mind the breakages experienced in Pindar during cyclone periods. I do not think there is any relationship between sweetness and brittleness.

A recent seedling production, and one which has gained a reputation for high c.c.s. is Q.58. Admittedly Q.58 is a rather brittle cane and it is possible that when being conveyed by high speed chains in a harvester it may be damaged as was Pindar in the J. & L. harvester. But, on the other hand Q.63, which produced such high sugar figures last year, is not brittle; nor are N.Co. 310 or Q.71 — two other high c.c.s. varieties. There is probably no reason to believe that high c.c.s. varieties will be brittle types but, naturally, plant breeders will guard against the selection of canes which are easily broken. This is important in a cyclone region and just as important if mechanization means rougher handling of the cane.

Another angle of mechanical harvesting which formed the subject of investigation by the Bureau in recent years was the rate of deterioration of cane when cut up into short lengths by a machine of the Massey Ferguson type. It was shown, as the result of a detailed study, that in a period of two days from burning and harvesting there was no appreciable deterioration over and above that experienced with whole cane. However, after a four-day period the loss in c.c.s. from cut-up cane was significantly greater than with whole cane. This work covered nine varieties, four locations and three harvesting periods during the season.

Programmed for this year is some research into a somewhat different aspect of the problem. This is based on the claim that cane should be cut down as soon as possible after burning, rather than allowed to stand perhaps for several days while the daily allotment is cut and loaded. An attempt will be made to measure the extent of c.c.s. and weight variation under the two different conditions.

Quite recently we have been doing some work on a quite new aspect of mechanical harvesting. You are all aware that, although the Massey Ferguson harvester can handle lodged

Fig. 5—Bli Bli Valley, Moreton district.
—Photo C. L. Toohey

Fig. 6—Setting out a variety trial on Meringa station.
Photo J. H. Buzacott

Fig. 7—Bundaberg Bulk Sugar Terminal.
—Photo N. McD. Smith

Fig. 8—An unusual view of the sugar sheds at the Townsville Harbour.
—Photo J. H. Buzacott

Fig. 9—Aerial view of Qunaba Mill and part of plantation.
—Photo N. McD. Smith

Fig. 10—Weighing new varieties of cowpeas in a field trial at Meringa.
—Photo J. H. Buzacott

Fig. 11—Planting seedlings in drills, Meringa 1958.
—Photo J. H. Buzacott

Fig. 12—Junior farmers at Mackay discussing improved pastures on Mr. T. Cook's property.
—Photo J. H. Buzacott

crops, the lying-down stalks are not topped and the green leaves and cabbage find their way into the bins. During last season we obtained from I.C.I. a few ounces of a new chemical substance which has the property, when sprayed onto green leaf material, of desiccating or drying out the green leaves in a few days and making them suitable for burning. This small amount of the chemical was used during the latter part of the 1959 season on a few short rows of standing cane within a cane block. The enlarged photographs on display illustrate the effect of the desiccating agent.

We used the chemical at the rate of 2½ and 5 lb. per acre. It was dissolved in water, sprayed onto the cane tops with a knapsack spray and after three days the leaves were brown, although not brittle. However, it was eleven days before the block was burnt for harvesting. In the treated sections the leaves burnt away to a much greater extent than in the remainder of the block, but the midribs and cabbage section were not consumed in the fire. A number of stalks were then cut from sprayed and unsprayed sections, the samples weighed, each stalk stopped at the correct point and the topped stalks again weighed. The weight differences were a measure of the amount of tops left on the treated and untreated section of the field.

The fact that the weight of tops was reduced by half is of considerable interest. The next step in this investigation is to ascertain whether the chemical will be as effective when sprayed onto lodged or badly-leaning cane. There is also the problem of how a lodged crop could be effectively sprayed prior to burning.

The production of a chemical leaf-desiccant is an extremely interesting step in many avenues of mechanical handling of crops. So far as we are aware our work in Queensland is the first to be reported on sugar cane and we are maintaining close contact with Imperial Chemical Industries and Plant Protection Ltd. to ensure that our programme of work will continue this year.

I have attempted this morning to survey some lines of work we have conducted or are conducting — all aimed at obtaining a better understanding of the many problems associated with mechanical cane harvesting. In some other countries of the sugar world mechanization of the harvest has been forced at short notice on the industry because of labour shortages or labour costs. We have the opportunity in Queensland of investigating many of the related problems before we enter into the phase of extensive mechanization; and we can be assured that when that time arrives the solution of many of the problems will be in our hands.

Ensilage from Cane in Soil Pits

One proposal being considered by some cane growers as a solution to the surplus cane problem is to make ensilage from the cane in soil pits. This may be a practical solution, using a forage harvester to shred the cane and reduce it to suitable condition for ensiling. However, the resulting ensilage would still lack balance as a stock food. Thought might be given to ensiling a mixture of cane and a green manure crop—velvet beans or cowpeas. The latter would raise the protein value of the resulting feed and save considerable expenditure on feed supplements. If surplus land is available on the farm green manure crops are cheap to produce and to harvest. Alternate layers of forage-harvested cane and cowpeas in a silage pit may be the answer to the problem.

The Diseases of Sugar Cane in North Queensland

By C. G. HUGHES

Introduction

A little more than a decade ago two dangerous diseases, downy mildew and gumming, were still present in North Queensland and their actual or potential threat dominated the pathological scene for some years. However, the last downy mildew stool was rogued in 1949 and the last known gumming diseased field ploughed out in 1950 and it is now fairly certain that these diseases have been eradicated from North Queensland. But this does not mean that the North no longer has its disease problems in the cane fields and the array of diseases which the pathologist and cane breeder have to face is still formidable. Several of these diseases force themselves on the farmer's notice by conspicuous symptoms and/or spectacular losses although there are others which could be just as damaging but they do not become obvious simply because varieties susceptible to them are not released for general distribution. This co-operation between pathologist and cane-breeder is a most important behind-the-scenes feature of the disease work in Queensland and is essential if losses due to disease are to be kept to a minimum.

Fig. 13—Droopy top can cause a severe loss of crop, as in this Pindar. In North Queensland the disease is controlled by soil dressings of copper sulphate.
—Photo C. G. Hughes

It is possible to state at a given time with a given varietal composition of the crop, that a certain disease is more serious than another, and some authors have even gone to the extent of drawing up neatly tabulated lists of major and minor diseases, but at best only a temporary classification can be made. It is not intended to attempt even this here and the diseases mentioned below are merely listed alphabetically.

Bacterial mottle

Bacterial mottle has been known in the Ingham district for a number of years and was first recorded in more northern parts in 1957, when outbreaks in the Mossman and Hambledon areas were discovered. It has now been reported in all Northern areas.

First symptoms of the disease consist of many white, regular stripes extending from the base or near the base of the leaf blade, upwards parallel with the vascular bundles. Orange to rusty-red areas later develop and eventually the greater portion of the blades becomes involved. Affected shoots arising from diseased stools are often badly stunted and the young leaves show fine irregular mottling of chlorotic and green areas. As these leaves mature, numerous small rusty-red flecks and short narrow stripes appear, the tip and edges wither, the leaves curl inwards and eventually the whole shoot dies. Diseased stalks often produce numerous side shoots at the base and standover cane may show a "witch's broom" effect of shot buds several feet from the ground. The side shoots show the characteristic mottling and rusty appearance.

Diseased leaves frequently show exudates on the lower surface where bacteria have oozed out through the stomates. In damp weather the drop of water found in the cabbage of the top is often milky with myriads of these bacteria. Diseased planting material gives rise to small sickly shoots which usually die out after a few weeks.

Losses in susceptible varieties such as Q.57, Q.66 and Trojan can be severe in individual fields but the disease is largely confined to flats liable to flooding and the disease would not be expected to pose a widespread threat to these canes.

Bacterial mottle occurs naturally in many grasses found in canefields and sources of infection are thus always present. Chief method of control, therefore, is by the use of resistant varieties in situations where the disease is likely to be severe. In any case it is foolish to plant from diseased crops.

Chlorotic streak

Chlorotic streak disease finds expression in cane in whitish streaks of irregular outline, reduced yields, poor germinations and ratoons, and increased susceptibility to shortage of soil moisture. It occurs in many cane-growing countries and in Australia has been found from Mossman to Grafton. It is practically always associated with wetter localities of poor drainage. Symptoms of the disease vary considerably from season to season during the year which makes it a difficult disease to work with, the fact that the disease cannot be inoculated into healthy plants is also a severe handicap to the research worker.

The disease is settransmitted but setts may be rendered free by immersion in water at 52°C (126°F) for 20 minutes; the recommended treatment of three hours at 50°C for ratoon stunting is also effective against chlorotic streak. The method of spread in the field is not known although transmission has been obtained in Louisiana by means of a leaf hopper and in a number of countries, including Queensland, transmission has been obtained by growing diseased and healthy plants in the same container of nutrient solution, gravel or soil.

Losses through chlorotic streak may be minimised by the use of clean plants but it should be pointed out that re-infection in the wet areas often occurs in the plant crop and almost invariably in the ratoons. Chlorotic streak is a problem disease and at the moment there is no effective control in sight. Bureau pathologists in common with pathologists in other parts of the world are working on the disease and it is

hoped that when more is understood of its cause and of its effect on the plant, an effective method of control will be forthcoming.

Droopy top

Any satisfactory definition of the term "disease" must make provision for inclusion of deficiencies : it is common enough in human pathology, e.g. beri-beri and scurvy, and should also apply to plants. Hence this mention of copper deficiency in an article on cane diseases.

Copper deficiency usually occurs in lighter sandy soils — one of the worst examples in recent years was on coastal sands at Mossman — and leads to a serious upset in the plant's metabolism. The most spectacular effect is a drooping of the entire top and this may be so bad that the young shoots are almost flat in the drill. Even varieties such as Trojan noted for their stiff upright top may have all leaves trailing limply on the ground. Growth is very much reduced and in extreme cases the small stunted stools fail to make cane and die.

The drooping top is usually sufficient for diagnosis of the disease but confirmation may be obtained from the leaf blades. These are much yellower than normal and they show characteristic "islands" maybe up to the size of a pencil top of normal green tissue.

Control is by the use of copper sulphate applied either broadcast or along the drill at the rate of 56 lb. per acre.

Leaf scald

Leaf-scald disease has long been a problem in North Queensland where it occurs in all the wetter localities. The damage it does varies depending on the varieties being grown, but it has the potential to wipe out a susceptible variety and has actually caused the discarding of many promising advanced seedlings.

Symptoms of leaf scald are regular longitudinal streaks about a whitened vascular bundle and running to dead areas at the leaf edges or tip, some general chlorosis, an inarching of the leaves to give a characteristic habit, side-shooting and often death. There is also the symptom of sudden death which without leaf markings at all, may occur in apparently normal plants late in the growing season.

The disease is sett transmitted and every effort should be made to get clean plants. It is also transmitted easily by cane knives or other harvesting blades. Diseased setts cannot be rendered disease-free by any known treatment and freedom from disease is dependent on selection of disease-free fields and sterilization of knives used in cutting the plants. The use of tolerant varieties e.g. Trojan, in which the disease may be masked for long periods, means that leaf scald is always present in commercial fields. Its control in the long run is dependent on resistant vareities but the breeding of them has proved very difficult since what appear to be resistant blood lines do not produce canes suitable for the North. In the meantime a calculated risk has to be taken; susceptible varieties will continue to be grown but every effort will be made to keep them disease-free. When stocks of them become too diseased they will have to be abandoned. Varieties such as Q.66 and Q.67, for instance, may be living on borrowed time with the threat of discard through leaf-scald disease forever hanging over them.

Pineapple disease

Pineapple disease is caused by a fungus which lives in the soil awaiting an opportunity to attack any cane sett slow in getting away. Poor quality plants may be the cause of the delay or more commonly, unsuitable soil moisture or temperature, and the struggling sett falls an easy victim. Poor germinations are particularly common in the cooler months and normally these are avoided, but on occasions plantings are made under unfavourable conditions in the hope

that the gamble might succeed. However the chances of success can be improved to almost a certainty if the setts be treated with a mercurial solution prior to planting. The several organic mercurials in common use in Queensland are equally effective. The solution containing .03 per cent. mercury can be sprayed onto the setts as they are cut in the cutter planter or the setts may be dipped. Control, except under exceptionally adverse circumstances, is usually complete and a good stand results. Some stimulation to the setts is also given and treated fields come away more quickly and more evenly than untreated. Most farmers have found that the use of a mercurial as a regular farm practice pays and even in Innisfail where the stick in the drill method is so often the only one possible on account of the weather, an improvement in germination has been obtained by treatment of the uncut stalks.

Pokkah boeng

The first rains of the wet season bring a flush of rapid growth and with it there is frequently a whitish fungal growth lightly spread about the base of the opening leaves. In many varieties this is all that happens but in others e.g. Q.50, the fungus has more serious effects. It may damage the leaf blade so that it collapses or it may spread onto the leaf sheath and rind. In severe cases the growing point is killed and top buds rapidly come away. The lesions are usually characterized by transverse necrotic areas arranged one above the other to give a ladder-like appearance. On the stem this may be accentuated so that the rind is broken deeply across and the symptom known descriptively as "knifecut" develops. Ladder lesions can also occur internally in the stalk, with or without death of the growing point.

Control measures by the farmer against pokkah boeng are not necessary and reliance must be placed on the resistance of the varieties available.

Ratoon stunting disease

A few short years ago ratoon stunting would have held pride of place in any disease survey of North Queensland. To-day, however, the control measures put forward by the Bureau have been so successful that commercial losses have been reduced to negligible proportions in most mill areas.

The symptoms are not obvious; the stunting and loss of yield have no specific features and the discolouration of the internal vascular bundles at the nodes and the pink colour in the young tissues can at times be very uncertain, even in cane known to be diseased. Control has been by use of clean seed, obtained by treating setts or sticks at 50°C for three hours. This is planted under the best possible conditions and used as a nursery for the propagation of sufficient plants for the whole farm. Ratoon stunting is easily transmitted per medium of the cane knife and care must be taken to prevent this as much as possible.

Red stripe and top rot

The bacterium causing red stripe and top-rot, which are two manifestations of the one disease, lives in the soil and can cause infection in seedlings in new ground. It is markedly seasonal in its severity and is usually worse following a dry spring and early summer.

The red-stripe stage shows narrow red stripes towards the base of the leaves of the young plants. In severe cases the loss of photosynthetic tissue may lead to some slackening in growth but normally the red-stripe stage does not cause any tonnage losses. The top rot stage can be much more serious. It follows infection of the growing point with the bacterium and the young tissue disintegrates into an evil-smelling mass. The spindle can be easily pulled out and since side shooting is generally inhibited

the affected stalk usually dies. The deaths occur early in the wet season so unless infection is unduly high, the remaining stalks in the stool usually make extra growth in compensation. A susceptible variety in a bad year may however be so damaged that serious tonnage loss results. This has happened with the new variety Q.67 and plantings of it should be made with the full realization that top rot could virtually wipe out the crop.

Control is chiefly through use of resistant varieties, but it has been found that autumn planted cane is less liable to attack than cane planted in the spring.

Yellow spot

It is likely that yellow spot has been present for a long time in North Queensland but it was not until infection became heavy in the susceptible Trojan in 1950 that attention was focussed on it.

Chief symptoms of the disease are the numerous yellow spots on the leaves, later they coalesce and become dotted with red and the leaves die prematurely. Autumn and winter growth is retarded, leaf area and ground cover are lost, the sugar content falls and harvesting is made difficult by the abundant weeds.

Experiments have indicated that dusting with a copper formulation will give control but the economics of the treatment have not been worked out. In the meantime Eros, Luna and Trojan should be avoided in localities liable to the disease.

General

The list of diseases above does not exhaust the diseases which a farmer in North Queensland may find on his farm but it does include all those which with the present varietal composition of the crop, are liable to cause losses. Freckles and spots on leaves, rots in the stalks, root infection, deficiencies other than copper, are some of the other troubles likely to arise.

The answer to any of the diseases is for the farmer to contact his local Bureau or Cane Pest and Disease Control officers as soon as they show; it is his best assurance against avoidable loss, and an investment in peace of mind.

Random Gleanings

A suggestion was made at the Conference of Cane Pest and Disease Control Boards last April that small areas of giant sensitive plant along roadsides might be controlled with heavy applications of 2, 4-D. It is known that 2, 4-D, applied at the rate of 2 lb. per hundred square feet, will eradicate all nut grass. Such a heavy dressing appears to sterilize the underlying soil completely for a lengthy period. Giant sensitive plant seed keeps germinating year after year even though the resulting plants are killed off before seeding—indicating that the original seed infestation can germinate progressively for several years. The 2, 4-D treatment is well worth trying. If one heavy application will kill all the seed it would be a simple method of cleaning up any small infestations. The sterilizing effect and the cost debar its being used for larger areas in cultivated fields.

The Sugar industry in Queensland has always been the largest user of potash among the varied agricultural industries of the Commonwealth. But it lost its position in 1959. Last year there were 12,293 tons of potash used on sugar cane, but there were 14,356 tons used on pastures and the bulk of this—10,014 tons—was applied in Victoria. The increase in potash usage on pastures has been meteoric, having risen to its present figure from less than 200 tons in 1952.

A Review of Chemical Weed Control in North Queensland Canefields

By C. A. REHBEIN and G. BATES

Control of weeds by chemical means has never been a general practice in the northern part of Queensland. Weeds have always been a problem to the canegrower even as far back as the pioneering days when cane was planted between the stumps. However, until arsenical weedicides were placed on the market, the growers had no choice but to use the chipping hoe. A few progressive farmers obtained reasonable results from this weedicide and more and more adopted the procedure, particularly amongst stumps and on stony properties. To some extent arsenicals proved a hazard to stock eating vegetation and grasses along headlands; furthermore, the use of this material was not popular among farm labourers. For these and other reasons chemical control of weeds remained static for quite a number of years. With the mechanization of sugar farms the stock hazard no longer worried the grower and as a result chemical sprays again began to find favour.

In the immediate post-war period, many new and varied chemicals were developed for use as weedicides. Included amongst these discoveries was the hormone-type weedicide 2,4-D (sodium salt of 2,4-dichlorophenoxy-acetic acid) which gave remarkable results in experimental trials. In canefields the desirability of obtaining an economical and successful weedicide was obvious since manpower for the manual task of cane weeding was in short supply and expensive to engage. The introduction of a chemical form of weed control was very well received by most growers. Particularly was this so in the case of pre-emergence weedicides, as the initial trials showed that control of all weeds and grasses could be expected for up to three months, provided the ground was in good tilth and free from germinating seeds at the time of application. At this time the main usage of 2,4-D in the sugar industry was for pre-emergence control, but it was also effective as a contact spray on many broad-leafed weeds whilst it had little or no effect on grasses after the three-leaf stage had been reached. It was particularly successful on Star of Bethlehem, a troublesome weed in the Mossman area.

Initial applications on field trials were carried out with knapsack spray, ensuring good coverage and correct dosage. These trials as a whole confirmed the preliminary reports issued on the weedicide, and subsequent applications on large areas by boom sprays fitted on tractor units showed generally favourable results although some breakdowns did occur. These breakdowns were first attributed to many minor faults such as the machine itself, mixing of the weedicide, poor tilth of the areas treated or growers' carelessness. It was later found that 2,4-D is readily decomposed by soil organisms and this probably was one of the chief reasons for failure. Another important factor in this aspect was that the grower expected far too much of the weedicide, in that once the spray was applied complete control was expected on soils where the weed seed population was astronomical. Under these circumstances if weeds appeared after soil movement or pooling during heavy rain, the method was considered to be a failure and was rarely repeated. These discouraged growers also discouraged their neighbours and expensive spray outfits are now lying discarded on quite a few farms when perhaps, with perseverance

with the application technique, the results may have been excellent.

The weed problem varies from farm to farm and from block to block so that, in using weedicides for this work, each problem has to be dealt with separately. In an area such as Babinda, where long periods of wet weather make cultivation either impossible or impracticable, the chemical control of weeds will certainly pay dividends. Some growers in the wetter areas are maintaining good chemical control of weeds during the early stages of growth. In the drier areas, generally weeds can be more readily controlled by cultivation, but here again some growers rely entirely on weedicides for the initial control of weeds whilst more pressing tasks are accomplished.

Plant cane has to be cultivated to fill in the drill prior to the cane becoming out of hand, and weeds usually are controlled by this operation. The next problem is that of weeds which grow after cultivation ceases. In earlier days, cultivation by horse-drawn implements was carried out until both horse and farmer were completely hidden by the cane, whilst now, with the mechanization of cane farms, cultivation necessarily ceases much earlier, and late weeds infest the crop more readily. This is strikingly shown in fields of an undulating nature where cane in the lower moist areas grows rapidly and prevents tractor work in the rest of the field. This is the weed problem that causes the grower most concern, for not only does the land become infested with weed seeds which cause subsequent trouble, but in many cases the weeds impede burning at harvesting and attract penalty rates for cutting. Of such weeds, probably the worst offenders are blue top (*Ageratum*), rattle pod (*Crotolaria* spp.), sensitive weed (*Mimosa*), *Star of Bethelem* (Ipomoea spp.), *Cleome aculeata, Convolvulus* (several species), and several species of burrs and guinea grass (*Panicum maximum*).

Most of these weeds can be easily controlled by chemicals, but the problem becomes one of application. The cane is too high for ordinary high clearance tractors and hand spraying is too slow and tedious except for isolated patches of specific weeds. Aerial spraying is possible in many cases, but not all farms lend themselves to this because of timber, power lines and hills which do not allow sufficient free room for manoeuvring. The danger of drift, which may damage other crops, has to be taken into consideration, and delays in time of application can be caused by numerous other factors. In 1959, 1,300 acres were treated from the air in the Cairns area and 40 acres in Mossman, and it is estimated that some 3,000 acres may be sprayed in 1960. Planes fitted with spray outfits are stationed at Mareeba where the aerial application of insecticides is successfully used on tobacco crops. Partial failures were experienced in cane in 1959, mainly in fields of varieties which give good foliage cover and prevent the weedicide from penetrating through the weeds. A further contributing factor to the partial failures was that, due to unfavourable weather conditions, spraying was not carried out at the right time, and weed growth had become too far advanced.

It is suggested that the ideal set-up for weed control would be a small inter-row tractor equipped with a spray outfit. One such tractor has been developed by a Hambledon grower using a 7 h.p. car engine. The outfit is equipped with three wheels with tanks fitted on either side of the single rear wheel. It is producing spectacular results, going through high cane in March and spraying at the rate of $\frac{3}{4}$ lb. of 2,4-D per acre. For the past three years, at the time of harvest there have been no weeds at all in the fields so treated.

It seems obvious from this paper that weed control by chemical means, after an initial flush of popularity, has not developed on a large scale in far North Queensland. However, the method, after a temporary recession, is now making some progress. Nevertheless, it appears unlikely that the chemical method will again achieve wide usage until the development of a weedicide which is not only easy to apply but is economical to use and, most important, reliable in its effect on weeds.

Insecticidal Experiments Against Soldier Fly

By R. B. MOLLER

Since the last conference a large number of trials against soldier fly have been harvested. In only one of these has any ratooning response been obtained. BHC at 4 lb. and 8 lb. gamma isomer per acre, applied as a broadcast dressing, grubbed in and left undisturbed for four weeks before planting produced normal ratoons whereas adjacent untreated control plots were very poor, as also were 2 lb. g.i. BHC, 4 lb. aldrin and 2.4 lb. dieldrin plots.

Stools have been examined from BHC-treated plots and have been found to be free of soldier fly larvae while stools from adjacent control plots yielded 48 and 21 larvae. Fifty-one larvae were also obtained from a stool in the aldrin-treated area.

Similar dressings of BHC have failed to give any control in several other trials. This is probably due to the time and/or method of application since some plots have been disced more deeply than in the successful trial. In the above-mentioned trial, the material was broadcast towards the end of May, 1958, and therefore it probably killed the insect at some highly susceptible stage, whereas July, August and September applications in other trials were apparently too late. An April application also proved ineffective. However, this was probably due to the field being planted only a week after the dust was applied, and just before soldier fly emergence was due to commence. Instead of having a uniformly protected surface as in fallow fields, the unprotected sides of the drill probably allowed emergence and re-establishment of the pest.

Several more trials along the lines of the above trial are to be established during the coming autumn. Because of the lesser cost and greater ease of application, lindane will be applied as a spray using boom spray equipment. There is some doubt as to whether a fallow treatment of lindane or BHC will provide sufficient protection for second ratoon crops. Consequently, the trial layout is so planned as to allow supplementary applications to be made after the plant crop has been harvested. Certain other aspects of the problem, viz. the method of working the lindane or BHC into the soil surface, and the question of whether the insecticide must be left undisturbed after the initial working and, if so, for how long, will also be investigated.

Problems of Grub Control and Varietal Reaction to Grub Attack in the Isis Area

By J. ANDERSON AND E. J. R. LUCKETT

Most northern growers are well acquainted with the severe losses caused by the "greyback" grub a decade or so ago. The spectacular and relatively cheap method of control achieved by the use of benzene hexachloride is now a normal farm practice in the north. However, grubs attacking cane in southern districts have not been kept in check by standard insecticidal treatments and a problem exists.

This state of affairs is due to various factors, principal of which are the nature of attack, the farm practices adopted in this area and the tolerance of the southern cane grubs to standard amounts of insecticides.

(1) Nature of Attack

The Childers cane beetle, (*Pseudoholophylla furfuracea*, Burm.) has a life cycle extending over two years. Damage occurs from October to March when the third stage grubs actively feed on the developing root system. Damage from these grubs is usually confined to patches throughout the block and grubs do not infest the whole block as is common in the case of the "greyback". Very often the adult lays its eggs near the point of emergence and so "grubby" patches tend to recur in the same place year after year. However, this habit is by no means certain and frequently fresh patches occur away from previously damaged areas. Since almost a year elapses from the time of beetle emergence to the time when the destructive third stage grub commences to damage cane, areas of infestation cannot be predicted with any certainty. An overriding factor which adds to the difficulty of predicting attack is the role that predators play in the suppression of larval populations.

(2) Farm Practices

There is a tendency for the female beetle to be attracted to a harbourage to lay its eggs. Hence two-year crops tend to serve as undisturbed and safe breeding grounds for grubs where they cannot be checked by cultural methods. Though not practised extensively, "ploughout and replanting" is very unwise as grubs may be at a safe depth when the land is being prepared during the cold winter-spring period; later, with the advent of warmer conditions, these grubs return near the surface to feed and inflict damage on the young plant crop. In contradistinction to these practices, however, timely cultural operations and the action of predators serve to reduce grub numbers and the net result is that grub populations are usually maintained at a fairly low, static level.

(3) Tolerance of Grubs to Standard Amount of Insecticides

The third stage furfuracea grub has proved more resistant than the "greyback" to soil insecticides and indications are that comparatively heavy applications of these insecticides are required for its control. In trials that have been established, 8 lb. of gamma BHC per acre (over 300 lb. p.a. of commercial 20 per cent. BHC dust 2.6 per cent. g.i.) appears to be the minimum dosage required. In view of the unpredictable occurrence of patchy areas of damage, the application of this quantity to the whole farm is not warranted because of the high costs involved.

Accordingly, until less expensive methods for the control of this pest are evolved, growers must continue to rely to a large extent on tolerant varieties to minimise damage.

Varietal Reaction to Grub Attack

More than one variety is often planted within a field, and "grubby" patches extending over these varieties give an opportunity to observe the relative merits of different varieties in withstanding grub attack.

Of the twelve on the approved variety list for the Isis mill area, C.P. 29-116 and N.Co. 310 appear the most tolerant to grub attack.

C.P. 29-116 has been the major variety for many years and owes its popularity to its ability to recover from severe hardships (drought and/or grubs) and produce a crop. By virtue of its excellent rooting system, it is able to recuperate quickly following grub attack.

In one instance, thirty third-stage grubs per stool were located and the resultant C.P. 29-116 stand ultimately yielded 35 tons per acre as a standover crop. Soil moisture was good at this period, but a corresponding crop of P.O.J. 2878 with only eight to ten grubs per stool was unfit to harvest.

N.Co. 310, also a strong rooting variety, can tolerate many grubs in a normal season before severe damage becomes evident. It recovers quickly following hardships, but its overall cropping ability is not as good as that of C.P. 29-116, and therefore is not planted so extensively.

Vesta is not as tolerant to grub attack as either C.P. 29-116 or N.Co. 310, though a fairly large population of grubs is required before noticeable damage occurs. Since this variety is being planted more extensively for standover purposes, more cases of damage in Vesta can be expected.

Pindar and Q.55 are more sensitive to grubs than Vesta and only a small number can be tolerated before they show distress.

Q.50 is a variety that is sensitive, since only a small population need be present to cause damage. In an autumn plant crop of Q.50, two or three grubs per stool caused severe damage while adjacent C.P.29-116 with the same population showed little damage.

Q.61 is more sensitive to grubs than Q.50. In a planting of Q.50 and Q.61, Q.61 showed death, whereas no actual death occurred in the Q.50.

Tolerant	Moderately Tolerant	Sensitive	Very sensitive
C.P.29-116 N.Co.310	Vesta	Pindar Q.55 Q.50 Q.61	P.O.J.2878 Q.58 Q.70

P.O.J.2878 is very sensitive to damage. Half of a field of P.O.J.2878 was supplied heavily with C.P.29-116. Following grub attack, the half of the block which contained only P.O.J.2878 was a complete failure and was rotaried in. The stools of P.O.J.2878 in the other half produced no crop at all while the C.P.29-116 supplies yielded a crop of 16 tons per acre.

Q.58, a recent addition to the approved variety list in the Isis area, has proved very sensitive to attack. On two occasions young ratoons showing a foot of cane were attacked. Only three grubs per stool were found and these were responsible for the death of the stool.

Q.70 is similar to Q.58 in that it is very sensitive and only a small number of grubs produce severe damage.

Q.69 and Q.72 have just been added to the approved variety list. They are not grown extensively yet, and therefore the reactions of these varieties to grubs are not known.

Varietal Trials — 1959 SEASON

By H. E. YOUNG

Northern Sugar Experiment Station, Gordonvale.
Block A.3.

Soil type: Brown-grey loam.
Age of crop: 13 months.
Nature of crop: First ratoon.
Harvested: July, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre		Summary		Gross return per acre less harvesting costs
	Plant	First Ratoon	Total cane per acre	Total sugar per acre	
	Tons	Tons	Tons	Tons	£ s. d.
Pindar	42.71	44.80	87.51	9.21	202 2 0
H.40-1184	38.28	41.53	79.81	8.11	173 13 0
M.701	34.00	36.21	70.21	7.25	155 6 0
M.614	30.32	33.79	64.11	7.69	191 4 0
C.P.43-47	28.95	37.20	66.15	7.98	197 16 0

DISCUSSION.

The crop ratooned well and the varieties behaved similarly to the plant crop. H.40-1184 was very vigorous, and C.P.43-47 was vigorous, stooled well but was thin. The two M. canes had much less vigour and grew more slowly, particularly M.614; M.701 arrowed very freely. All varieties stood up well. Pindar produced the highest cane tonnage and the most sugar per acre as in the plant crop and gave the greatest gross return, followed by C.P.43-47, M.614, H.40-1184 and M.701 in that order.

BRIE BRIE ESTATE, Mossman.

Soil type: Grey-brown clay loam.
Age of crop: 13 months.
Nature of crop: Plant.
Harvested: August, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
Pindar	49.79	16.14	8.03	165 15 0
L.688	34.73	14.86	5.16	101 3 0
L.703	32.64	17.26	5.63	120 10 0
K.717	32.33	16.70	5.39	113 9 0
L.622	29.46	16.78	4.94	104 5 0

DISCUSSION

L.688 germinated the quickest followed by Pindar, K.717, L.622 and L.703, which latter was very slow. L.688 was the slowest to stool and L.703 was also retarded. After the dry weather Pindar revived quickly and was soon well ahead of the others. K.717 lodged after the burn and L.688 snapped off just above the ground. Pindar produced the highest tonnage of cane and sugar per acre and gave the greatest gross return followed by L.703, K.717, L.622 and L.688.

COWE BROTHERS, Saltwater, Mossman.

Soil type: Yellow-grey clay loam. **Nature of crop:** Plant.
Age of crop: 14 months. **Harvested:** September, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
Pindar	35.75	16.06	5.74	118 0 0
Q.70	34.71	15.60	5.41	109 7 0
Q.61	30.08	16.06	4.83	99 6 0
Q.63	29.63	17.06	5.05	107 11 0
Q.58	27.56	16.00	4.40	90 10 0

DISCUSSION.

Pindar and Q.70 were the most vigorous varieties in the early stages, followed by Q.58, Q.63 and Q.61. At harvest Pindar was still the leader while Q.70 now displayed its proneness to lodging. Q.61 suffered badly from pokkah-boeng, and Q.63 had opened out. Q.58, although lower in tonnage, was erect, had a heavy stool and good cover. Pindar produced the highest tonnage and sugar per acre and gave the greatest gross return followed by Q.70, Q.63, Q.61 and Q.58.

MOHAMMED AND SONS, Hambledon.

Soil type: Red-brown sandy clay loam. **Nature of crop:** Plant.
Age of crop: 15 months. **Harvested:** September, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
Q.70	38.18	17.81	6.80	147 16 0
Pindar	35.69	16.80	5.99	126 8 0
Q.58	30.31	17.21	5.21	111 8 0
Q.61	29.40	17.34	5.09	109 6 0
Q.63	28.51	18.86	5.37	120 5 0

DISCUSSION.

All varieties germinated well, particularly Q.70. All varieties were severely affected by drought in the latter part of the year. With rain Pindar revived first followed by Q.70, Q.63, Q.58 and Q.61. At harvest Q.70 was well ahead of other Q. canes in tonnage but was slightly sprawled, as was Q.61; Q.63 was open and had arrowed. A severe infection of pokkah-boeng affected Q.61. Agriculturally Q.58 appeared the most suited to the soil type. The greatest gross return was produced by Q.70 followed by Pindar, Q.63, Q.58 and Q.61.

E. and E. G. SANTOLIN, Miriwinni.

Soil type: Grey granite gravel. **Nature of crop:** Plant.
Age of crop: 12 months. **Harvested:** July, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
Q.63	33.81	13.05	4.41	78 9 0
Q.70	36.80	11.68	4.30	69 0 0
Pindar	37.46	10.68	4.00	57 19 0
Q.58	36.11	10.82	3.91	57 12 0
Q.62	35.42	9.98	3.47	46 12 0

DISCUSSION.

Germination was fast for all varieties. Q.62 made the best growth in the early stages followed by Pindar, Q.70, Q.63 and Q.58. By December Pindar was superior to the Q. varieties in appearance. Q.70 and Q.58 did well and Q.62 slowed down in the wet season. Yellow spot was very prevalent in Q.58 and Q.63 during April. Many plots commenced to lodge in April with Pindar the least affected. Q.63 produced the greatest monetary return followed by Q.70, Pindar, Q.58 and Q.62, in that order. Q.63 produced the largest amount of sugar and Pindar the greatest tonnage per acre.

G. ZAPPALA, Miriwinni.

Soil type: Grey-black alluvial clay loam. **Nature of crop:** Plant.
Age of crop: 14 months. **Harvested:** August, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in czne	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
Q.57	43.75	15.07	6.59	130 7 0
K.717	41.69	14.67	6.14	118 16 0
L.703	40.86	14.64	5.98	115 19 0
L.622	39.77	12.86	5.11	89 13 0
L.688	36.88	12.58	4.64	79 15 0

DISCUSSION

Germination was fast, with L.703 the slowest to come away. As maturity approached both K.717 and L.703 sprawled badly, as did odd plots of Q.57. On burning L.688 snapped off at the base. The trial showed the superiority of Q.57 on this soil type. The highest tonnage, sugar yield and monetary return were produced by Q.57, followed by K.717, L.703, L.622 and L.688 in that order.

LOWER BURDEKIN SUGAR EXPERIMENT STATION, Brandon.
Randomized Block Trial.

Soil type: Sandy allivial loam. **Nature of crop:** Plant.
Age of crop: 15 months. **Harvested:** October, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
54A.414	38.45	18.87	7.25	162 6 0
54A.547	43.10	18.65	8.03	178 17 0
Vidar	37.04	18.30	6.78	149 4 0
Trojan	42.52	18.24	7.75	170 13 0
54A.555	41.30	17.62	7.28	153 6 0
Pindar	41.15	17.16	7.06	150 15 0

DISCUSSION.

Germination was good in all varieties except Vidar which had 70 per cent. of the standard Trojan strike. The February cyclone did considerable damage to Pindar, up to 70 per cent. of the tops being broken. 54A.414 was the most erect variety after the cyclone. Vidar showed severe bending and 54A.555 was slightly sprawled. Recovery from the cyclone was quick. Arrowing was heavy in Pindar and 54A.414. 54A.547, as usual, did not arrow and showed reasonable early sugar for this variety. 54A.547 was the best stooling variety.

Variety 54A.547 produced the highest tonnage, sugar and monetary return per acre followed by Trojan. 54A.414 came next in return but was beaten by 54A.555 in tonnage and sugar production. Pindar came next, followed by Vidar. Stalk rots due to cyclone damage probably account for the poor performance of Pindar.

E. W. and L. L. WRIGHT (ex D. Bongioletti), North Gooburrum.

Soil type: Red forest sandy loam. **Nature of crop.** Second ratoon.
Age of crop: 11 months. **Harvested:** July, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre			Summary		Gross return per acre less harvesting costs
	Plant	First Ratoon	Second Ratoon	Total cane per acre	Total sugar per acre	
	Tons	Tons	Tons	Tons	Tons	£ s. d.
Q.50	16.65	35.12	35.80	87.57	13.25	331 0 0
Q.58	16.37	34.63	41.92	92.92	13.75	333 14 0
C.P.29-116	13.99	38.34	38.75	91.08	12.02	266 1 0
L.74	13.64	35.61	38.95	88.20	13.54	327 16 0
Q.71	12.94	35.40	34.02	82.36	13.48	347 8 0
Q.63	12.66	36.10	31.50	80.26	12.33	305 18 0
M.98	12.03	32.60	33.25	77.88	11.63	284 2 0

DISCUSSION.

All varieties ratooned satisfactorily. M.98 was the most vigorous cane in the early stages, with Q.63 being the poorest. M.98 arrowed first but did not show any drought distress in dry weather whilst L.74 showed a marked sensitivity to droughty conditions and was prone to stem rot infections. The highest total return has been given by Q.71 followed by Q.58, Q.50, L.74, Q.63, M.98 and C.P.29-116 in that order.

A. E. KELLY AND SONS, North Isis.

Soil type: Red volcanic loam. **Nature of crop:** First ratoon.
Age of crop: 15 months **Harvested:** October, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
C.P.29-116	48.04	15.55	7.47	150 10 0
L.76	44.04	16.92	7.46	157 16 0
L.46	37.48	16.68	6.25	131 6 0
Q.50	37.41	16.85	6.30	133 2 0
L.74	35.54	17.28	7.14	131 10 0
L.77	35.40	17.90	6.33	138 2 0
L.79	33.55	16.15	5.42	111 14 0

DISCUSSION:

The plant crop of this trial was not weighed as it had been severely affected by drought. However all varieties ratooned satisfactorily. C.P.29-116 produced the highest tonnage per acre but was exceeded in gross return, sugar per acre and c.c.s. by L.76. The variety L.77 produced the highest c.c.s. and followed L.76 and C.P.29-116 in gross return. Q.50 was next best in return and cane tonnage but was exceeded by L.77 in c.c.s. L.74, L.46 and L.79 followed in that order in regard to gross return and sugar per acre.

SEE BROTHERS, No. 2, North Isis.

Soil type: Red forest loam. **Nature of crop:** Standover plant.
Age of crop: 19 months. **Harvested:** July, 1959.

SUMMARY OF CROP YIELDS

Variety	Cane per acre	c.c.s. in cane	Sugar per acre	Gross return per acre less harvesting costs
	tons	per cent.	tons	£ s. d.
Q.72	44.45	14.39	6.39	122 12 0
L.46	38.69	14.40	5.57	106 14 0
Vesta	38.23	14.57	5.57	107 10 0
P.O.J.2878	34.91	14.53	5.07	98 0 0

DISCUSSION.

At germination L.46 was outstanding for vigour and speed; Vesta was very slow but the final strike was good in all varieties. At harvest there was no sign of arrowing in any variety and no lodging was evident. The highest tonnage in cane and sugar and greatest monetary return was produced by Q.72 (H.46); Vesta had the highest c.c.s. and was second to Q.72 in return and equalled L.46 in sugar per acre. P.O.J.2878 gave the lowest tonnage, sugar per acre and gross return.

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The Bureau offers the following free services to *all* cane growers in Queensland:—

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Your soil will be analysed by the most modern methods, and a report will be posted containing a recommendation covering the type of fertilizer required, the amount per acre, the need for lime, and other relevant information. Phone the nearest Bureau office and the soil samples will be taken as soon as possible.

Culture of Green Manure Seed

Cultures and instructions for the inoculation of the seed of cowpeas, velvet beans, mung beans or any other legume will be posted to any cane grower upon request to The Director, Bureau of Sugar Experiment Stations, Brisbane. Allow a week after receipt of your letter for the culture to be prepared and posted, but as the culture will easily keep a month or so it is a good idea to get your culture when you get your seed. If sowing is delayed, ask for another batch of culture; there is no charge.

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